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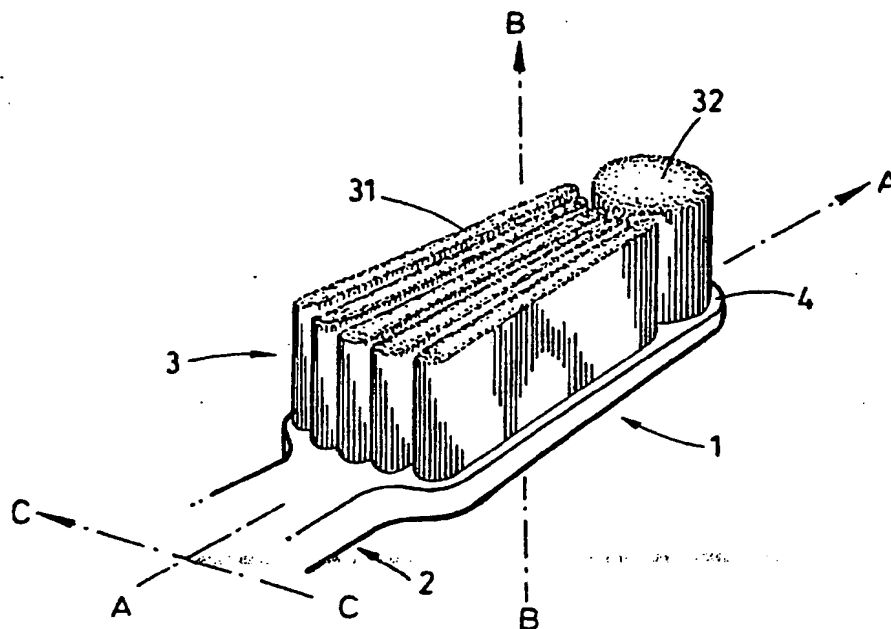
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(54) Title: **BRISTLE ARRANGEMENT FOR A TOOTHBRUSH**



(57) Abstract

A toothbrush is provided with a first set of discrete tufts (31) that are generally rectangular in the cross section perpendicular to the tuft axis with the larger dimension running parallel to the side of the brush head (1). A second set of tufts (32) is provided at the end of the head (1) remote from the handle, this set of tufts, or single tuft, having a cross section perpendicular to the tuft axis that is either 'C' or 'U' shaped or rounded. The arrangement of bristle tufts described provides a lower brushing stiffness in a direction transverse to the longitudinal axis of the brush.

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## BRISTLE ARRANGEMENT FOR A TOOTHBRUSH

This invention relates to a novel device, being a toothbrush.

5 Toothbrushes are well known articles, and generally comprise a handle, having at one end thereof a bristle-bearing head, all aligned along a longitudinal toothbrush axis. The bristles on such a head are normally arranged in a pattern of discrete tufts mounted in sockets in a bristle face of the head and extending generally perpendicular to the bristle face. In known toothbrushes such tufts are substantially circular in cross section and are mounted in substantially circular section sockets in  
10 the head.

Toothbrushes having bristles arranged in a single "mat" covering substantially the entire area of the bristle face are known, e.g in US 4646381, which also discloses a toothbrush having a combination of circular sectioned tufts, oval sectioned and rectangular sectioned tufts located within a middle area of a larger mat of individual  
15 bristles covering a substantial area of the bristle face. US 4268933 discloses a toothbrush having bristles arranged in large tufts of a rectangular shape, having their long dimension aligned substantially across the width of the toothbrush head. US 2209173 discloses a toothbrush having elongated rectangular tufts of bristles with their long dimension aligned substantially parallel to the toothbrush axis, alternating  
20 with rectangular tufts which tilt together, the bristles in the tufts being flattened to form a sharp-edged tuft .

Bristle tufts having a substantially circular cross section have substantially the same stiffness to bending perpendicular to the longitudinal axis of the bristles in the tuft ("the tuft axis") whether this direction is parallel to the toothbrush axis or  
25 perpendicular to the toothbrush axis, i.e across the width of the toothbrush. This can have the disadvantage that the tufts have substantially the same stiffness when the head is being moved generally in the direction of the toothbrush axis across the teeth parallel to the gumline, as when the head is being moved in a direction generally perpendicular to the toothbrush axis, up and down the teeth, crossing the gumline. It  
30 is desirable that a toothbrush is softer, ie has less stiffness to bending when brushing across the gumline, to prevent injury to the gumline.

The inventors have devised a toothbrush having a tuft pattern of elongated mats of bristles, with a rounded tuft of bristles at the end of the head remote from the handle.

35 The invention therefore provides a toothbrush, having a handle and at one end thereof a bristle bearing head, the bristles on the head all being arranged in a pattern of a plurality of discrete tufts projecting from a face ("bristle face") of the toothbrush head in a direction generally perpendicular to the toothbrush axis, characterised by one or more of the tufts ("first tufts") having a cross section perpendicular to the tuft

axis which has a greater dimension in the direction generally parallel to the toothbrush axis than in the direction generally perpendicular to the toothbrush axis, in combination with one or more tufts ("second tufts") at the end of the tuft pattern remote from the handle, the second tufts being in the form of either (i) a pattern of  
5 discrete tufts arranged in a generally circular or polygonal pattern, or (ii) a single tuft of generally rounded cross section perpendicular to the bristle face, or (iii) a tuft of generally "C" or "U" shaped cross section perpendicular to the bristle face having at least one of the limbs of the "C" or "U" aligned generally parallel to the longitudinal toothbrush axis and with the rounded bend of the "C" or "U" facing the end of the  
10 bristle face remote from the handle.

The term "generally parallel to the longitudinal toothbrush axis" includes all directions between absolutely parallel to the longitudinal axis and parallel to the longitudinal sides of the head of the toothbrush. The term "generally circular" includes semicircular.

15 Typically each of such first tufts covers no more than 25% of the area of the bristle face of the head, for example no more than 20%, suitably less than 10%, preferably less than 5%, for example 1 - 2 % of the area of the bristle face. Typically such tufts may have a ratio of dimension in a direction generally parallel to the toothbrush axis (i.e "long dimension") : dimension in a direction generally  
20 perpendicular to the toothbrush axis (i.e "width dimension") of 1.5 : 1 or more, suitably 2 : 1 or more, e.g 2.5 : 1 or more, for example between 2.5 - 3.5 : 1.

The cross section of such first tufts may for example be generally rectangular in shape over a substantial part of their cross-sectional area, having the long dimension of the rectangle aligned generally parallel to the toothbrush axis. The term  
25 "generally rectangular" includes *inter-alia* rectangular with rounded corners, lozenge-shaped (i.e two generally parallel long sides and two rounded ends), parallelogram-shaped and trapezoidal-shaped.

Alternatively the cross section of one or more of the first tufts may have other generally linear polygonal or rounded shapes having a length dimension aligned  
30 generally parallel or substantially parallel to the toothbrush axis, for example diamond shaped or rectangular with one or more pointed ends, "L" shaped having a first limb aligned generally parallel to the toothbrush axis and a second limb aligned at an angle to the first limb, e.g at about 45° to the first limb, or "V" shaped having at least one, preferably both, of the limbs of the "V" aligned at an angle less than about  
35 45° to the toothbrush axis.

The toothbrush may have a single first tuft or a number of first tufts, and the tufts may be of differing cross-sectional shapes combined, for example rectangular or lozenge shaped combined with "L" shaped. Typically the toothbrush of the invention may have between 2 to 25 first tufts, which may all be generally rectangular or

lozenge shaped.

For example a first embodiment of the toothbrush of the invention may have a pattern of first tufts which have a generally rectangular cross section perpendicular to the tuft axis, arranged on its bristle face, the first tufts each having a long dimension  
5 between about 0.1 and 0.9, for example between 0.25 - 0.75 of the overall length of the bristle face, with a width dimension between about 0.05 and 0.5, suitably between about 0.1 and 0.5 of the width of the bristle face. Typically the pattern of first tufts may comprise between 5 and 20 of such tufts, for example between 5 and 12. Such first tufts thereby comprise a pattern of long rectangular or lozenge shaped tufts, with  
10 their long axes aligned generally parallel to the bristle face. Such first tufts may for example each have such a long dimension, e.g about 0.75 of the length of the bristle face, that each tuft extends substantially along the entire length of the bristle face occupied by the first tufts. Alternatively the long dimension of individual such first tufts may for example be such, e.g about 0.1 - 0.5 of the length of the bristle face, that  
15 such first tufts are arranged in two or more, e.g 2 - 6, lateral rows across the width of the bristle face. The first tufts in this first embodiment may be symmetrically disposed about the longitudinal axis of the toothbrush.

Alternatively for example a second embodiment of the toothbrush of the invention may have a tuft pattern comprising 2 or more straight or curved lateral  
20 rows, aligned generally across the width of the bristle face, of first tufts, combined with, for example alternating with, one or more straight or curved rows aligned generally across the width of the bristle face, of tufts ("third tufts") which are of generally circular section. The first and third tufts of this second embodiment may be symmetrically disposed about the longitudinal axis of the toothbrush.

Again alternatively for example a third embodiment of the toothbrush of the invention may have a pattern comprising 2 or more straight or curved lateral rows, aligned generally across the width of the bristle face, of first tufts, combined with, for example alternating with, one or more straight or curved rows aligned generally  
25 across the width of the bristle face, of third tufts which are of generally rectangular (as defined above) section having their longest dimension aligned across the width of the bristle face. The first and third tufts of this third embodiment may be symmetrically disposed about the longitudinal axis of the toothbrush.

Typically in such a toothbrush there may be 2 to 5, for example 4, lateral rows of first tufts, combined with 1 to 4, for example 3, rows of third tufts. In the rows of  
35 first tufts there may for example be 2 to 5 e.g 4 tufts abreast across the width of the bristle face, and in the rows of third tufts there may be for example 2 to 5, e.g 4 third tufts of generally circular section, or 1 to 3, e.g. 2 third tufts of generally rectangular section having their longest dimension aligned across the width of the bristle face, abreast across the width of the bristle face.

Alternatively for example a fourth embodiment of the toothbrush of the invention may have a pattern of first tufts which have a generally rectangular cross section perpendicular to the tuft axis, arranged on its bristle face, the first tufts each having a long dimension between about 0.10 - 0.9, typically between about 0.25 - 0.5, of the overall length of the bristle face, typically the pattern of first tufts may comprise between 2 and 20 of such first tufts, for example between 5 and 12, such first tufts being combined with one or more first tufts which are "L" shaped having a first limb aligned generally parallel to the toothbrush axis and a second limb aligned at an angle to the first limb, e.g at about 45° to the first limb. Such "L" shaped first tufts may be disposed at the end of the bristle face closest to the handle. The first tufts of this second embodiment may be symmetrically disposed about the longitudinal axis of the toothbrush, and preferably the toothbrush of this embodiment has an even number of such "L" shaped first tufts disposed symmetrically on either side of the longitudinal axis of the toothbrush.

When the second tufts comprise a pattern of discrete tufts arranged in a generally circular or polygonal pattern such second tufts may be in a pattern of tufts of generally circular section arranged in generally a circle, semi-circle, or polygon (each corner of which corresponding to a centre of one of its tufts), which may comprise a pattern of individual tufts arranged around a central tuft. Typically a central tuft may be surrounded by a regular, e.g a hexagonal, pattern of such tufts symmetrically arranged, for example such that there are equal numbers of second tufts, e.g 3 of the surrounding tufts, disposed on either side of the longitudinal axis of the toothbrush. The diameter of such a pattern may typically be around 0.5 - 0.95 of the width of the bristle face in the vicinity of the pattern.

When the second tufts comprise a single tuft of generally rounded, e.g circular, oval or semicircular or semioval cross section perpendicular to the bristle face the diameter of such a tuft may typically be around 0.5 - 0.95 of the width of the bristle face in the vicinity of the tuft.

When the second tufts comprise a tuft of generally "C" or "U" shaped cross section perpendicular to the bristle face having at least one of the limbs of the "C" or "U" aligned generally parallel to the longitudinal toothbrush axis and with the rounded bend of the "C" or "U" facing the end of the bristle face remote from the handle the diameter of the rounded part of such a tuft may typically be around 0.6 - 0.9 of the width of the bristle face in the vicinity of the tuft. The longitudinal axis of the toothbrush may symmetrically bisect the "C" or "U".

Tufts of generally circular cross section may additionally or alternatively be combined with the above described first, second and third tufts having a cross section, perpendicular to the tuft axis, which has a greater dimension in the direction generally parallel to the toothbrush axis than in the direction generally perpendicular to the

toothbrush axis in other ways.

The bristles within the first, second and third tufts may be of substantially all the same length, so that the face of the tuft is substantially flat, or alternatively the length of the bristles in the tuft axis direction may vary in length at different points along the direction of the toothbrush axis, or perpendicular to this axis. Such a variation is particularly applicable to toothbrushes of this invention which have alternating rows of tufts of different sections as described above, such as in the second and third embodiments, and where the individual rows may vary in the length of the bristles contained in them. For example relative to the toothbrush axis the tuft may have a "rippled" or "sawtooth" profile of alternating peaks and troughs, for example as described in DE 34 33 763, WO 91/19437, EP 0449653A, US 4672706, US 451911, US 4268933, US 3229318, US 3188673, US 2797429, US 1943225 and US 74,560 etc.

Suitably the first tufts may comprise bristles of shorter length than those in the second and third tufts, and those of the second and third tufts may be of substantially the same length.

The bristles making up the tufts may be made of plastics materials conventional to the art of toothbrush bristles, for example Nylon. The bristles may be of generally conventional construction, e.g linear filaments of the bristle material having rounded polished ends.

The handle and head may be made of plastics materials conventional to the art of toothbrush handles. The head and handle may be of an overall shape conventional to the art of toothbrushes, and the handle may for example include one or more 'V' shaped folds to modify the flexibility characteristics of the handle, for example as described in EP 0336641 A. The handle may also include one or more grip-enhancing portions for example in the form of rubbery grip mats, for example as also described in EP 0336641 A.

The tufts and individual bristles may be mounted in the toothbrush head by essentially conventional techniques. Preferably the bristles are mounted into the toothbrush head by a process in which the ends of the bristles in the tuft to be fastened into the head ("the fastening ends") are fused together into a mass by heating, and this mass is subsequently or simultaneously fused with the toothbrush head material, by heating the bristles or the mass and the head material to the point of softening, bringing them into contact so that they fuse together, and then cooling them to solidification, so that the tuft is in-effect welded into the head. Suitably the head may be preformed with one or more sockets corresponding to the position, number and size of the tuft(s), and the tuft(s) may be fused as described above with the head material around the socket(s). For manufacture by such a process the bristles and head must be made of thermoplastic materials, for example known thermoplastic

materials such as nylon at present used in toothbrush manufacture. Suitable processes for making a toothbrush in this way are for example described in US 2664316 and WO 93/12690, the contents of which are included herein by reference.

5 In an alternative method of making the toothbrush of the invention the bristles of the tufts may be first fused into a thermoplastic block in the above-described tuft pattern, for example using the above-described fusion process, and this block may then be inserted and fixed, e.g by heat welding, into a cavity in the head of the toothbrush, or alternatively the head of the toothbrush may be moulded around the block.

10 Alternative methods of making a toothbrush of the invention will be apparent to those skilled in the art.

The toothbrush of this invention may be used in an essentially conventional manner by the user, and the tuft patterns of the toothbrushes of this invention are believed to improve the cleaning efficiency of the toothbrush and is also believed to help to reduce gum injury.

15 The invention will now be described by way of example only with reference to the accompanying drawings, which are intended to be representative only and not limiting the general concept of this invention.

20 Figs. 1, 2, 3, 4 and 5 show perspective views of heads of toothbrushes of this invention.

Figs. 6, 7, 8 and 9 show plan views of tuft patterns of the bristle faces of heads of toothbrushes of this invention.

Fig. 10 shows a longitudinal section through the toothbrush of Fig 9.

25 Referring to Figs 1 to 5 toothbrush heads (1) are shown. Each head (1) is connected to an integral handle (2). The toothbrush axis is indicated by the line A - A in Fig 1, the tuft axis by the line B - B in Fig 1, and the width direction of the head (1) by the line C - C in Fig 1.

30 On each of the heads (1) of Figs 1 to 5 are mounted tufts (3, generally) extending generally perpendicularly to the bristle face (1A) of the head (1) generally in the direction of a tuft axis B-B.

35 In Fig 1 first tufts (31) are rectangular in cross section taken perpendicular to the tuft axis B - B with two rounded ends, ie lozenge shaped. The pattern of tufts comprises a number tufts (31) having a long dimension of 0.5 or more of the length of the bristle face (4), which is substantially greater than their width dimension, the long dimension being aligned substantially parallel to the toothbrush axis and with one large second tuft (32) of circular cross section perpendicular to the tuft axis (B - B), at the end of the bristle face (4) remote from the handle (2).

In Fig 2 the first tufts (31) are lozenge-shaped in cross section taken perpendicular to the tuft axis B - B, first tufts (34) are "L" shaped in cross section



taken perpendicular to the tuft axis B - B, with a first limb substantially rectangular in cross section with its long limb aligned generally parallel to the toothbrush axis, and a second limb (34A) at an angle of about 45° to the first limb. A second tuft (32) is in the shape in section taken perpendicular to the tuft axis B - B of a "U" shape having  
5 two limbs aligned substantially parallel to the toothbrush axis, and its rounded bottom adjacent to the end of the head (1) remote from the handle (2). The longitudinal axis A-A of the toothbrush bisects the "U" between its two limbs.

In Fig 3 first tufts (31) are generally rectangular, i.e, lozenge-shaped in cross section taken perpendicular to the tuft axis B - B, and are arranged in a series of five  
10 curved lateral rows each of four first tufts (31) abreast aligned generally across the width of the bristle face (4). At the end of the bristle face (4) remote from the handle (2) is a pattern of second tufts (32) of generally circular cross section arranged in a symmetrical hexagonal pattern around a central tuft. The diameter of the pattern of second tufts (32) is about 0.9 of the width of the bristle face (4) taken through the  
15 centre of the pattern.

In Fig 4 first tufts (31) are generally rectangular, i.e, lozenge-shaped in cross section taken perpendicular to the tuft axis B - B, and are arranged in a series of four straight lateral rows each of four first tufts (31) abreast, aligned generally across the width of the bristle face (4). Between alternate rows of first tufts (31) are located  
20 straight rows of third tufts (33) aligned generally across the width of the bristle face, of tufts (33) which are of generally circular section. At the end of the bristle face (1A) remote from the handle (2) is a pattern of second tufts (32) of generally circular cross section arranged in a symmetrical hexagonal pattern around a central tuft. The second tufts (32) and third tufts (33) are longer in the tuft axis direction B-B than the  
25 first tufts (31).

In Fig 5 first tufts (31) are generally rectangular, i.e, lozenge-shaped in cross section taken perpendicular to the tuft axis B - B, and are arranged in a series of four straight rows each of four first tufts (31) abreast, aligned generally across the width of the bristle face (1A). Between alternate rows of first tufts (31) are located straight  
30 rows of third tufts (33) which are of generally rectangular section, but having their longest dimension aligned across the width of the bristle face (1A), and which are aligned generally across the width of the bristle face. At the end of the bristle face (1A) remote from the handle (2) is a pattern of second tufts (32) of generally circular cross section arranged in a symmetrical hexagonal pattern around a central tuft. The  
35 second tufts (32) and third tufts (33) are longer in the tuft axis direction B-B than the first tufts (31).

In Figs. 6 to 9, plan views of heads of (1) of toothbrushes of the invention are shown, looking down the tuft axis B-B.

In the toothbrushes of Figs. 6 and 7, patterns of tufts (31, 32) similar to those

in the toothbrush of Fig. 3 are shown. The pattern comprises first tufts (31) which are lozenge-shaped in cross section taken perpendicular to the tuft axis B - B, and are arranged in a series of lateral rows aligned generally across the width of the bristle face (4), these rows being curved in Fig. 6 (i.e as shown in Fig. 3) and straight in Fig.

5 7. The longitudinal dimension of the first tufts (31) is such that five first tufts occupy the length of the bristle face (4) occupied by first tufts (31). At the end of the bristle face (4) remote from the handle (2) is a pattern of second tufts (32) of generally circular cross section arranged in a symmetrical hexagonal pattern around a central tuft (32).

10 In the toothbrushes of Figs. 8 and 9, patterns of tufts (31, 32, 33) similar to those in the toothbrush of Figs. 4 and 5 are respectively shown. The patterns comprise first tufts (31) which are lozenge-shaped in cross section taken perpendicular to the tuft axis B - B, and arranged in a series of straight lateral rows, aligned generally across the width of the bristle face (1A). Between alternate rows of first tufts (31) are  
15 respectively located straight rows of third tufts (33) aligned generally across the width of the bristle face. In Fig. 8 the third tufts (33) are of generally circular section. In Fig 9 the third tufts (33) are of generally rectangular section, ie lozenge shaped, having their longest dimension aligned across the width of the bristle face (4). At the end of the bristle face (4) remote from the handle (2) is a pattern of second tufts (32) of  
20 generally circular cross section arranged in a symmetrical hexagonal pattern around a central tuft.

Referring to Fig 10, the head of the toothbrush shown in Fig. 9 is shown in a longitudinal section about the staggered axis (D - D) shown in Fig 9. The toothbrush comprises a head (1), a handle (2), and first (31), second (32), and third (33) tufts.

25 The tufts (31, 32, 33) comprise individual bristles all generally aligned in the direction of the tuft axis (B - B) perpendicular to the bristle face (4). The ends of the bristles in the tufts (31, 32, 33) have been fastened into the head (1) by fusing them by heat into a mass (5) then cooling. In the bristle face (1A) head are located sockets (6), and each mass (5) is located in a socket (6) and fused in place therein with the  
30 material of the toothbrush head (1), both the head material and bristle material being thermoplastic. The tufts (31, 32, 33) of the toothbrushes of Figs. 1 to 8 are fastened into the heads (1) of their respective toothbrushes in a similar way to that shown in Fig. 10. The technique used to fuse the mass (5) into the socket (6) may be that of US 2664316 or WO 93/10639, or other known methods, and the fixing of the tufts (31,  
35 32, 33) into the head (1) is shown only representatively.

## Claims:

1. A toothbrush, having a handle and at one end thereof a bristle bearing head, the bristles on the head all being arranged in a pattern of a plurality of discrete tufts projecting from a face ("bristle face") of the toothbrush head in a direction generally perpendicular to the toothbrush axis, characterised by one or more of the tufts ("first tufts") having a cross section perpendicular to the tuft axis which has a greater dimension in the direction generally parallel to the toothbrush axis than in the direction generally perpendicular to the toothbrush axis, in combination with one or more tufts ("second tufts") at the end of the tuft pattern remote from the handle, the second tufts being in the form of either (i) a pattern of discrete tufts arranged in a generally circular or polygonal pattern, or (ii) a single tuft of generally rounded cross section perpendicular to the bristle face, or (iii) a tuft of generally "C" or "U" shaped cross section perpendicular to the bristle face having at least one of the limbs of the "C" or "U" aligned generally parallel to the longitudinal toothbrush axis and with the rounded bend of the "C" or "U" facing the end of the bristle face remote from the handle.
2. A toothbrush according to claim 1 characterised in that each of the first tufts covers no more than 25% of the area of the bristle face of the head.
3. A toothbrush according to claim 1 or 2 characterised in that the cross section of such first tufts is generally rectangular in shape over a substantial part of their cross-sectional area, having the long dimension of the rectangle aligned generally parallel to the toothbrush axis.
4. A toothbrush according to claim 1, 2 or 3 characterised in that the cross section of one or more of the first tufts have other generally linear polygonal or rounded shapes having a length dimension aligned generally parallel or substantially parallel to the toothbrush axis.
5. A toothbrush according to claim 4 characterised in that the cross section of one or more of the first tufts is "L" shaped having a first limb aligned generally parallel to the toothbrush axis and a second limb aligned at an angle to the first limb.
6. A toothbrush according to any one of the preceding claims characterised by having between 2 to 25 first tufts, being all of generally rectangular or lozenge shape.
7. A toothbrush according to claim 1 characterised by having a pattern of first

tufts which have a generally rectangular cross section perpendicular to the tuft axis, arranged on its bristle face, the first tufts each having a long dimension between about 0.1 and 0.9 of the overall length of the bristle face, with a width dimension between about 0.05 and 0.5 of the width of the bristle face, comprising between 5 and 20 of such first tufts.

8. A toothbrush according to claim 7 characterised in that the first tufts each have a long dimension that each tuft extends substantially along the entire length of the bristle face occupied by the first tufts.

9. A toothbrush according to claim 7 characterised in that the long dimension of individual such first tufts is such that the first tufts are arranged in two or more lateral rows across the width of the bristle face.

10. A toothbrush according to claim 1 characterised by having a tuft pattern comprising 2 or more straight or curved lateral rows, aligned generally across the width of the bristle face, of first tufts, combined with, one or more straight or curved lateral rows aligned generally across the width of the bristle face, of third tufts which are of generally circular section.

11. A toothbrush according to claim 1 characterised by having a tuft pattern comprising 2 or more straight or curved lateral rows, aligned generally across the width of the bristle face, of first tufts combined with one or more straight or curved rows aligned generally across the width of the bristle face, of third tufts which are of generally rectangular section having their longest dimension aligned across the width of the bristle face.

12. A toothbrush according to claim 10 or 11 characterised by 2 to 5 lateral rows of first tufts, combined with 1 to 4 rows of third tufts.

13. A toothbrush according to claim 10, 11 or 12 characterised by 2 to 5 first tufts abreast across the width of the bristle face.

14. A toothbrush according to claim 10, 11, 12 or 13 characterised by 2 to 5 third tufts of generally circular section, or 1 to 3 third tufts of generally rectangular section having their longest dimension aligned across the width of the bristle face, abreast across the width of the bristle face.

15. A toothbrush according to claim 1 characterised by having a pattern of first

tufts arranged on its bristle face, the first tufts each having a long dimension between about 0.10 - 0.9 of the overall length of the bristle face, comprising between 2 and 20 of such first tufts, such first tufts being combined with one or more first tufts which are "L" shaped having a first limb aligned generally parallel to the toothbrush axis  
5 and a second limb aligned at an angle to the first limb.

16. A toothbrush according to any one of the preceding claims characterised in that when the second tufts comprise a pattern of discrete tufts arranged in a generally circular or polygonal pattern such second tufts are in a pattern of tufts of generally  
10 circular section arranged in generally a circle or polygon, each corner of which corresponding to a centre of one of its tufts, which is arranged around a central tuft.

17. A toothbrush according to claim 16 characterised by a central tuft surrounded by a hexagonal pattern of 6 such tufts symmetrically arranged such that three of the  
15 surrounding tufts are disposed on either side of the longitudinal axis of the toothbrush.

18. A toothbrush according to claim 17 characterised in that the diameter of the hexagonal pattern is around 0.5 - 0.95 of the width of the bristle face in the vicinity of  
20 the pattern.

19. A toothbrush according to any one of claims 1 to 15 characterised in that when the second tufts comprise a single tuft of generally rounded section perpendicular to the bristle face the diameter of such a tuft is around 0.5 - 0.95 of the  
25 width of the bristle face in the vicinity of the tuft.

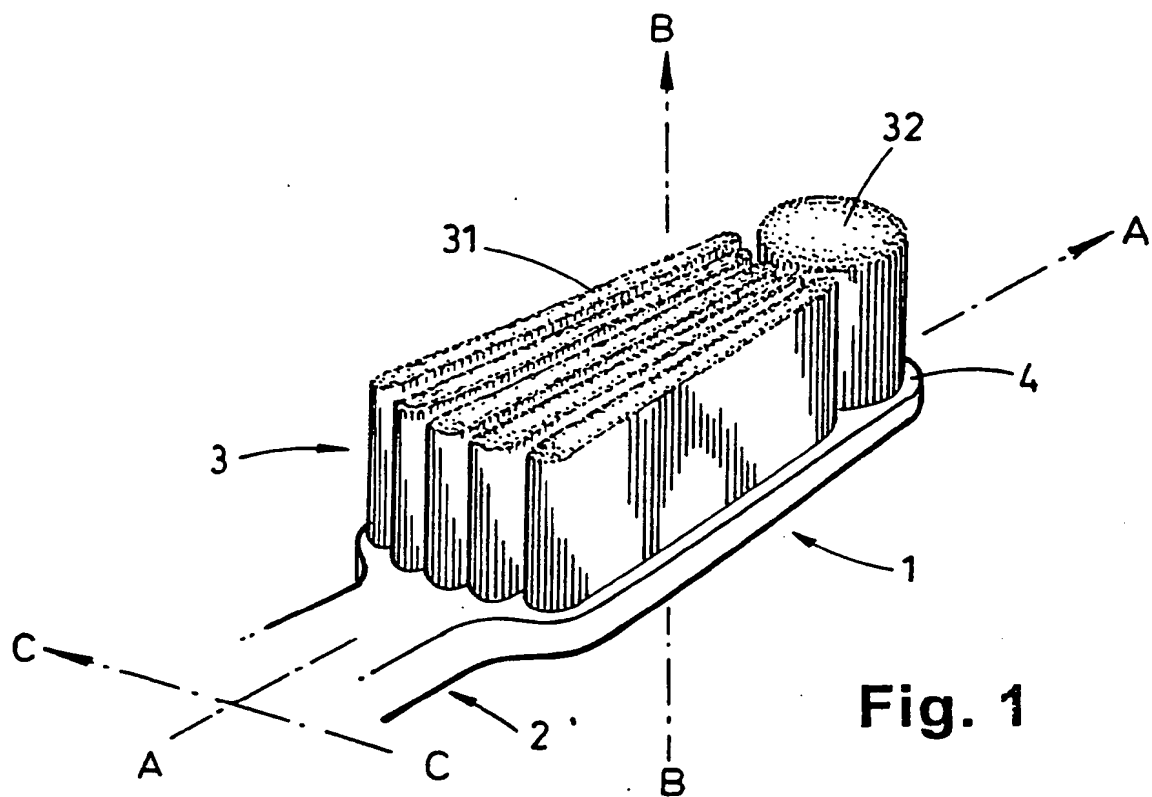
20. A toothbrush according to any one of claims 1 to 15 characterised in that when the second tufts comprise a tuft of generally "C" or "U" shaped cross section perpendicular to the bristle face having at least one of the limbs of the "C" or "U"  
30 aligned generally parallel to the longitudinal toothbrush axis and with the rounded bend of the "C" or "U" facing the end of the bristle face remote from the handle the diameter of the rounded part of such a tuft is around 0.6 - 0.9 of the width of the bristle face in the vicinity of the tuft.

35 21. A toothbrush according to any one of claims 1 to 20 characterised in that the first tufts comprise bristles of shorter length than those in the second and third tufts, and those of the second and third tufts are of substantially the same length.

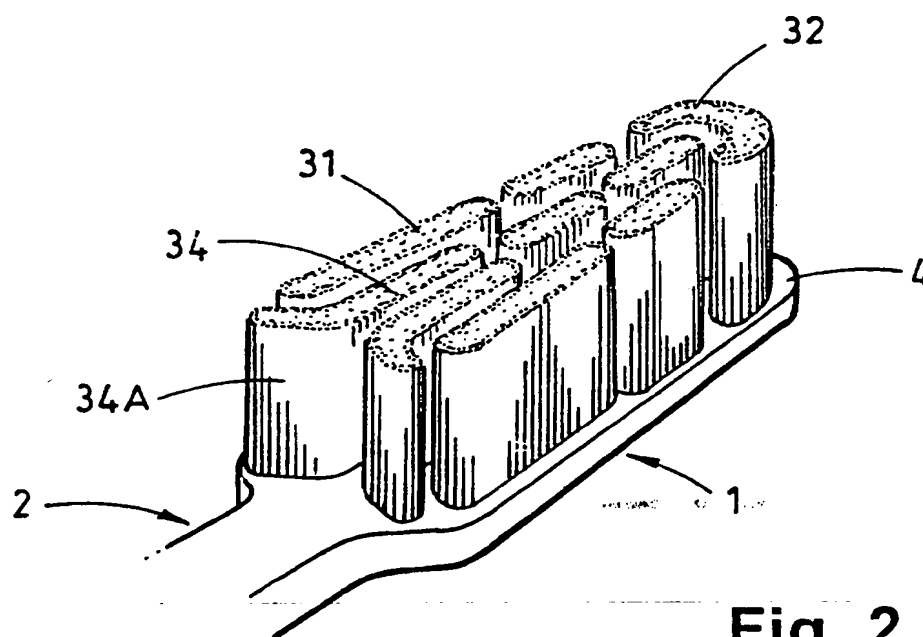
22. A toothbrush according to any one of the preceding claims characterised in

that the tufts and individual bristles are mounted into the toothbrush head by a process in which the ends of the bristles in the tuft to be fastened into the head ("the fastening ends") are fused together into a mass by heating, and this mass is subsequently or simultaneously fused with the toothbrush head material, by heating the bristles or the  
5 mass and the head material to the point of softening, bringing them into contact so that they fuse together, and then cooling them to solidification, so that the tuft is in effect welded into the head.

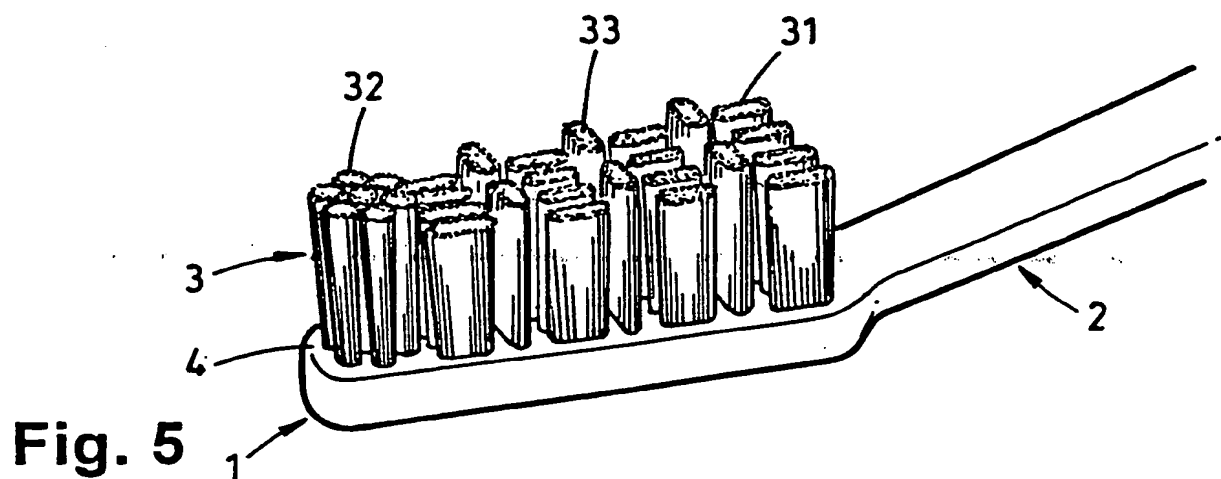
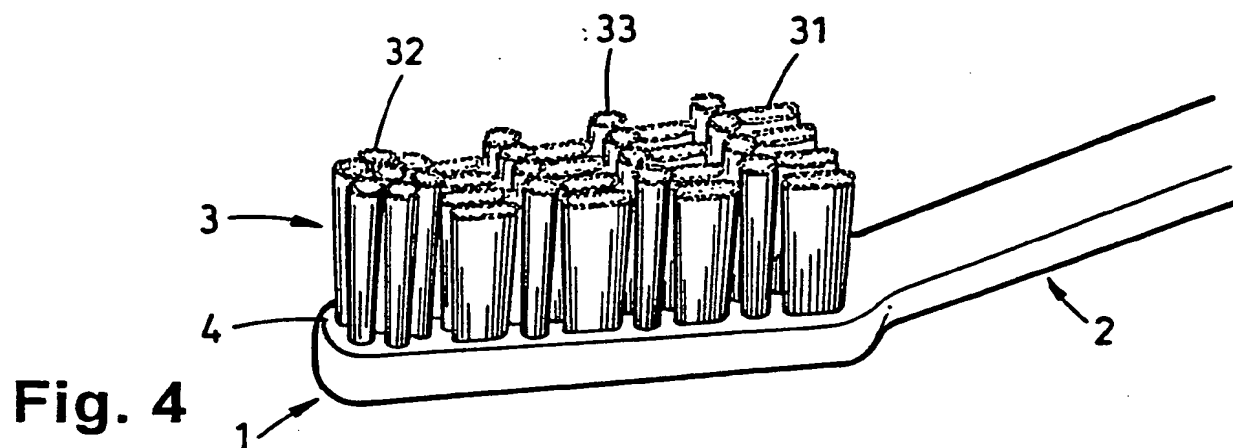
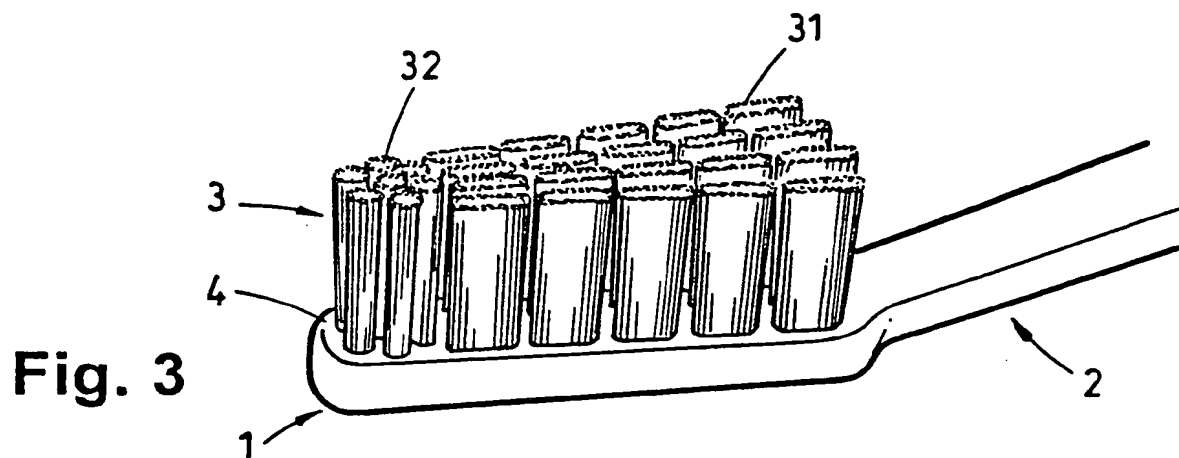
23. A toothbrush according to any one of the preceding claims, substantially as  
10 hereinbefore described with reference to the accompanying drawings.



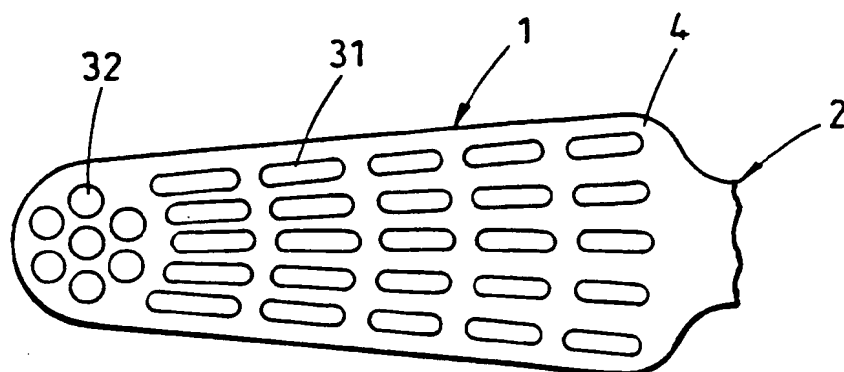
**Fig. 1**



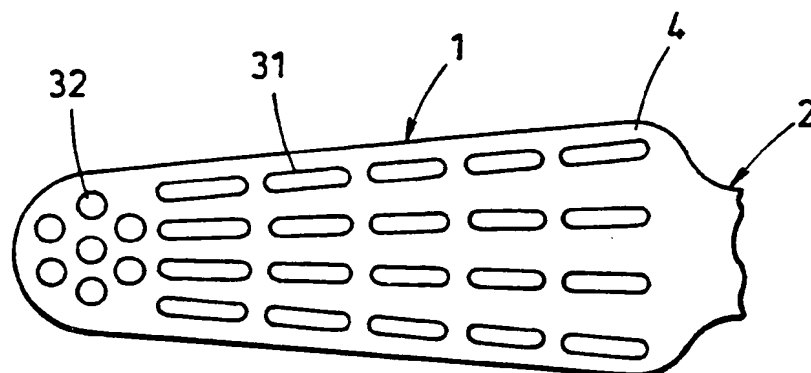
## Fig. 2



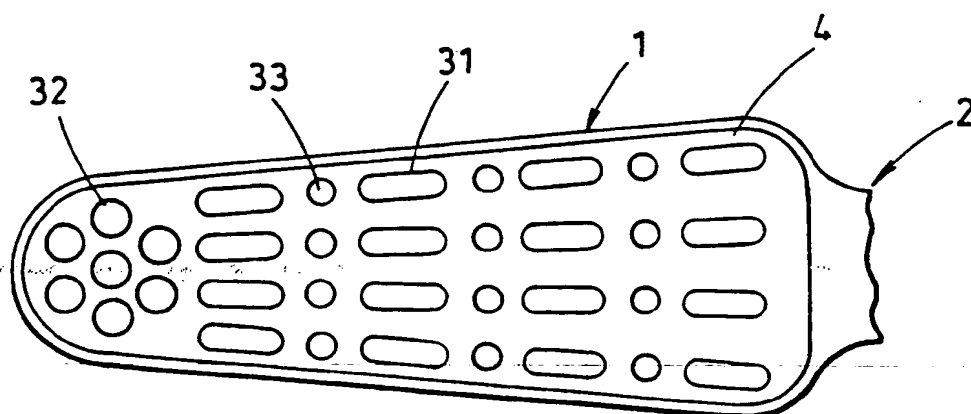




**Fig. 6**



**Fig. 7**



**Fig. 8**

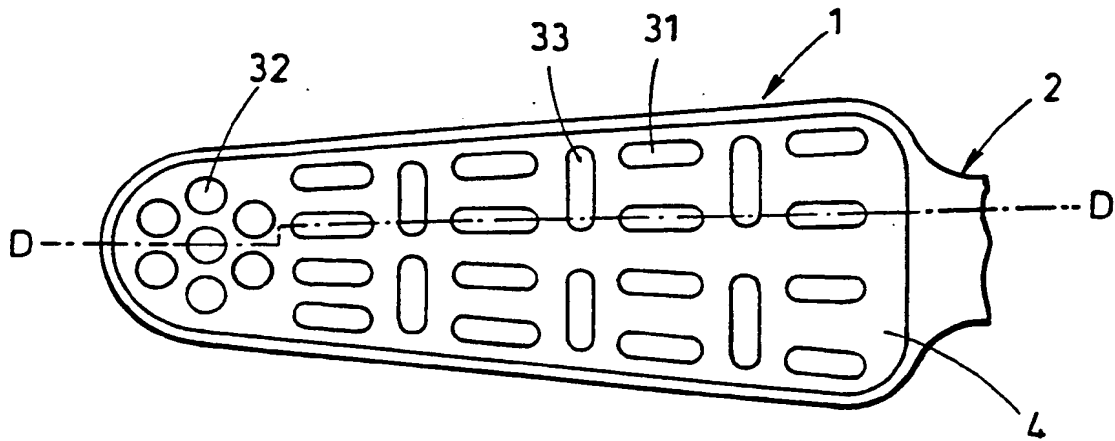


Fig. 9

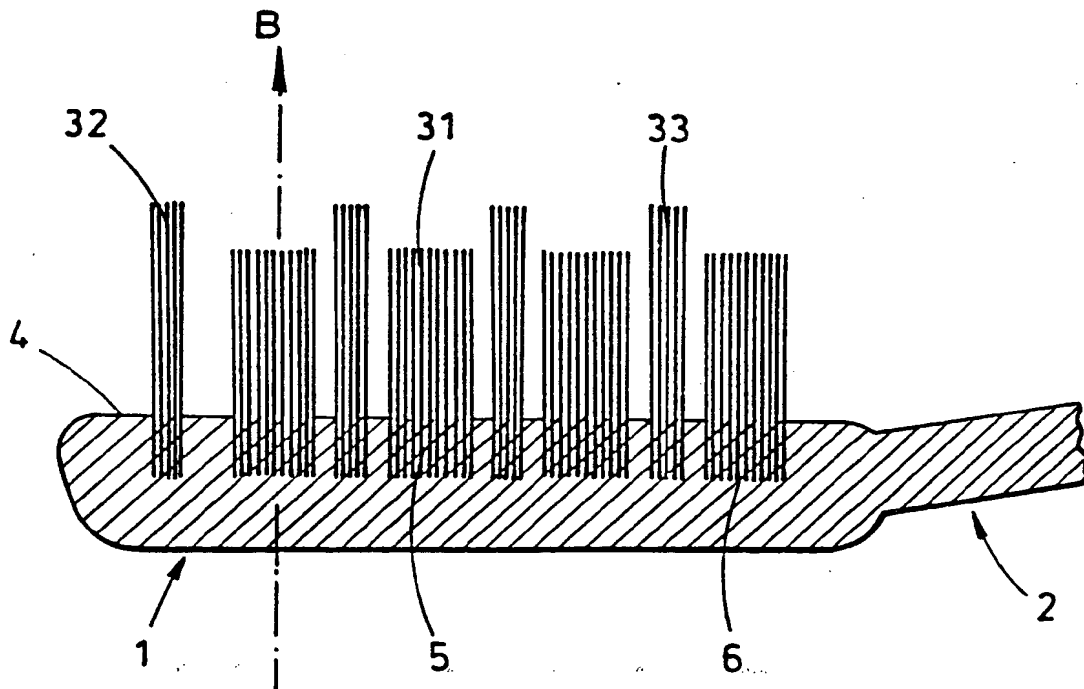


Fig. 10

## INTERNATIONAL SEARCH REPORT

International Application No

PCT/EP 94/02828

A. CLASSIFICATION OF SUBJECT MATTER  
IPC 6 A46B9/04

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)  
IPC 6 A46B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
P,A	WO,A,94 09677 (GILLETTE CANADA) 11 May 1994 see page 4, line 24 - page 5, line 16; figures ---	1
A	US,A,3 214 777 (KUTIK) 2 November 1965 see column 1, line 11 - column 4, line 16; figures ---	1
A	EP,A,0 142 885 (NORTH AMERICAN PHILIPS CORP.) 29 May 1985 see page 7, line 23 - line 38; claim 1; figure 6 ---	1
A	FR,A,733 823 (GREILSAMER) 12 October 1932 see the whole document -----	1

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Date of the actual completion of the international search

5 December 1994

Date of mailing of the international search report

19.12.94

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# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/EP 94/02828

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FR-A-733823		NONE	